The Institute of Physics

BULLETIN

APRIL 1956 · VOL. 7 · No. 4

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The Bulletin is published by The Institute of Physics for circulation to its members ; copies should not be placed in libraries.

Notices to Members

Malayan Branch

In accordance with the requirements of By-Law 38 a formal request has been made for the establishment of a Branch of the Institute in Malaya and at its meeting on March 20 the Board approved the formation of the Branch. Mr. C. G. Webb (*Associate*), Head of the Physics Department of the University of Malaya is acting as Chairman of the provisional Branch Committee with Dr. S. P. Thong (*Associate*) as the Honorary Secretary.

Payment of Subscriptions

Members have again responded very readily to the request that subscriptions should be remitted with the form included in the January *Bulletin*. This co-operation saves much work and expense in avoiding the need for individual reminders.

Electron Physics Colloquia

The Physical Society and The Institute of Physics have organized joint Colloquia on Electron Physics. These have been held regularly once every term during the last two years. The subjects which have been discussed so far are :—(1) Electron optics, (2) Scattering of electrons, (3) New kinds of thermionic cathodes, (4) Secondary electron emission, (5) Interaction of electrons with electromagnetic fields, (6) Electron diffraction.

The Colloquia have varied somewhat in size and in scope as the occasion required, ranging from symposia lasting a whole day to

discussion meetings of a few hours in the afternoon. The attendance was always very large and had to be limited according to the accommodation of the lecture theatre available.

The range of subjects to be dealt with by the joint Colloquia will comprise :—(1) Electron optics and electron motion, (2) Interaction between free electrons and electromagnetic waves including centimetre waves, also X-ray production, absorption and scattering, (3) Interaction of free electrons with atoms (including diffraction, scattering and ionization but excluding gas discharges), (4) Electron emission (electron structure of solids is included only so far as it is necessary for the understanding of emission processes).

There are about 200 members of The Physical Society on the mailing list of the Electron Physics Colloquia. Members of The Institute of Physics are notified about the Colloquia if they belong to the Electronics Group. Other groups (e.g. the Electron Microscopy Group) receive invitations when the subject to be discussed is in the sphere of their particular interest.

It is intended to continue the Colloquia as a regular institution. The members who in the past have notified their interest in the Colloquia are invited to propose subjects and speakers for future Colloquia and to communicate their suggestions to one of the members of the Joint Committee who are as follows :—

For The Physical Society : Dr. M. Blackman (Physics Department, Imperial College, London, S.W.7), Mr. D. W. Fry (Atomic Energy Research Establishment, Harwell Didcot, Berks), Dr. O. Klemperer (Hon. Secretary of the Committee, Physics Department, Imperial College, London, S.W.7), Professor H. S. W. Massey (Physics Department, University College, London, W.C.1).

For The Institute of Physics : Dr. V. E. Cosslett (Cavendish Laboratory, Cambridge), Mr. M. E. Haine (Chairman of the Committee, Research Laboratories, Associated Electrical Industries Ltd., Aldermaston, Bucks), Mr. S. Rodda (Edison Swan Electric Co. Ltd., Brimsdown Works, Enfield, Middlesex). One further Institute representative is to be appointed.

The Institute's Finances

For those members who wish to have a simple general picture of the Institute's financial affairs as a whole, a set of consolidated accounts is published in the *Bulletin* each year. These combine the Institute's own accounts with those of the Endowment Trust Fund. The full details will be found in the more formal statements included in the Board's annual report (p.101 of this issue) which will be presented for adoption to the Annual General Meeting to be held on July 16 next.

The year shows a final net surplus of £460 compared with a budgeted surplus of £715. In comparing these figures it must be noted that in view of the increased income from the Institute's publications, particularly the Journals, the loan of £2,000 from the X-ray Index Fund towards the cost of the production of a book written by members of the X-ray Analysis Group, was not taken.

The Institute became liable for an increased rent of £735 p.a. for the House from Midsummer and allowance has been made for this. Of the £13,038 noted as Bank Balances £7,754 is on deposit, and most of it represents subscriptions to the Journals for 1956 which will be required during the year to pay printing and publishing expenses.

On the whole, the year may be considered to have been reasonably satisfactory financially, and the Board wishes to record its thanks to its various Standing Committees and to the Branch and Group Committees for assisting the permanent officers to prevent overspending at a time of rising costs. The Institute's financial reserves are still very slender as will be seen from the consolidated balance sheet and its liquid reserves are still far too low to allow for the desirable growth of the Institute's many activities. With continually rising costs in printing, postage and most other items, close control of expenditure is essential, as the Institute is only just able to meet its existing commitments.

THE INSTITUTE OF PHYSICS

CONSOLIDATED INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST DECEMBER, 1955

1954		£
	To Office and General Expenses :—	
13,945	Salaries and National Insurance and staff superannuation	14,087
4,320	Rent, rates, lighting, cleaning and maintenance	4,565
1,206	Postage and telephone	1,493
620	Travelling expenses, Board and Committee Meetings	681
17,668	„ Production and distribution of publications (excluding cost of office labour and overheads)	21,401
1,372	„ Miscellaneous office expenses, printing and stationery	2,082
323	„ Bulletin (net)	354
2,100	„ Branches and Groups (including Australia) ...	2,093
350	„ Conferences and Conventions	134
225	„ Educational work, examinations (net) and special reports	230
785	„ Miscellaneous expenses and House vote ...	1,175
582	„ List of Members	—
300	„ Science Abstracts, basic payments	300
43,796		48,595
1,671	„ Copies of Journals supplied to Members ...	2,052
1,315	„ Decrease in stock of publications...	1,398
—	„ Surplus for the year before deduction for depreciation, etc.	2,223
£46,782		£54,268
570	To Deficiency brought down	—
309	„ Amount written off expenditure on alterations, etc., to House	359
381	„ Depreciation of furniture and fittings	419
985	„ Leasehold Redemption Policy Premium ...	985
Cr. 181	„ Books, stock depreciation reserve adjustment ...	—
—	„ Final surplus for the year	460
£2,064		£2,223

1954		£
23,562	By Receipts from publications	29,175
7,662	„ Receipts from advertisements in Journals ...	9,291
12,390	„ Members' subscriptions, entrance and application fees	13,121
277	„ Dividends and interest	419
150	„ Donations received by Trust Fund	210
500	„ Contribution from X-Ray Index Fund for publication of book	—
44,541		52,216
1,671	„ Copies of Journals supplied to members... ...	2,052
570	„ Deficiency for the year	—
£46,782		£54,268
—	By Surplus brought down	2,223
2,064	„ Final deficiency for the year	—
£2,064		£2,223

THE INSTITUTE OF PHYSICS

CONSOLIDATED BALANCE SHEET, 31st DECEMBER, 1955

1954			
£		£	£
4,948	LIFE MEMBERSHIP FUND	4,906	
17,583	RESERVE FUND...	17,433	
100	ENDOWMENT TRUST FUND	100	
2,038	RESERVE FOR STOCK OF BOOKS DEPRECIATION ...	2,000	
	CURRENT LIABILITIES :—		
9,542	Subscriptions to 1956 Journals and payments from members in advance	6,243	
2,632	For Expenses, including production of publications	6,491	
10,037	X-Ray Index Fund	12,184	
6	Bowen Prize Fund	—	
1,625	Mrs. Phillips' Bequest	1,770	
£48,511			£51,127

1954			
£		£	£
	FIXED ASSETS :—		
	FURNITURE, FITTINGS AND OFFICE EQUIPMENT, at cost	5,593	
1,992	*Less :* Depreciation	3,509	2,084
	ALTERATIONS, IMPROVEMENTS AND ADAPTATION OF PREMISES, at cost	10,289	
6,875	*Less :* Depreciation	3,774	6,515
	CURRENT ASSETS :—		
7,661	STOCK OF PUBLICATIONS ON HAND, at valuation		6,175
6,499	DEBTORS		4,883
53	SUBSCRIPTIONS IN ARREARS		78
12,294	INVESTMENTS, at cost ... ... (*Estimated market value at 31st December, £11,035*)		12,294
4,925	LEASEHOLD REDEMPTION POLICY ...		5,910
6,424	BANK BALANCES AND CASH IN HAND ...		13,038
1,788	ENDOWMENT TRUST FUND, INCOME AND EXPENDITURE ACCOUNT BALANCE (deficit)		150
£48,511			£51,127

Vol. 7, April, 1956

Too Many Masters

(or Gossip and Grumbles on Technical Education)

By Professor M. R. GAVIN, M.B.E., M.A., D.Sc., M.I.E.E., F.Inst.P.

(*University College of North Wales, Bangor*)

INTRODUCTION

MUCH HAS been written on the subject of Technical Education in recent years. National and local advisory councils, government-sponsored committees, professional institutions, trade unions in general and trade unions associated with technical teaching in particular, government departments, employers' federations and trade associations—these and many other bodies and individuals have had their say. All are agreed on the tremendous importance of technical education to the country's welfare and on the need for its development and extension to meet the urgent demands of this highly technical age. However, there the unanimity ceases, and widely divergent views have been expressed on policies for fulfilling the need. There are, no doubt, many causes of the divergence but only two of the more important ones will be mentioned here. So many subjects in widely varying fields are dealt with in technical colleges that it is easy to talk at cross purposes. Some of the many commentators and advisers have been more knowledgeable than others, but frequently they have been discussing different things. The other reason for divergence is the varying background and outlook of the commentators. In some cases there have been vested interests, and views have been coloured by the ambitions or whims of the individuals or bodies expressing them.

The present comments are concerned primarily with higher technological education, not because the writer considers it to be more important than the training of the technician and the craftsman, but because his experience has been mainly in that branch. As he has just left the field of technical education and is unlikely to return to it, he hopes that he will be able to express views which are based on some inside knowledge but are without underlying motive. In the original invitation to write these comments the Editor stated that "heresy will be quite acceptable, with no restrictions and nothing barred." It is largely in that spirit that the comments are made. The writer has a very high regard for the work being done in some of the bigger colleges, and he is fully convinced of the important part they have to play in the field of higher technology. Most of the comments that follow are of a critical nature and no attempt has been made to emphasize merits and virtues. The criticisms are meant to be constructive. They may be considered unfair and misguided in certain respects, but they are offered with sincerity, and are based on a strong desire to see technical colleges play their full part in the training of technologists.

TOO MANY MASTERS

For establishments concerned with such an important function as the training of professional engineers or technologists it is extraordinary that they should be subject to the control of so many outside bodies. Amongst the masters that the colleges have to serve and obey may be mentioned Local Education Authorities, the Ministry of Education, Professional Institutions, the University of London, Examining Unions, the Burnham Committee and their own Governing Bodies. The position is even worse than this list would indicate since most of these bodies are in reality multi-headed monsters.

THE LOCAL EDUCATION AUTHORITIES

The relationship between college and L.E.A. varies enormously throughout the country. The author was fortunate in being employed by one of the more enlightened authorities. No reasonable request for teaching staff or equipment was ever turned down, and provision, on the whole, was on a generous scale, in so far as it was dependent on the senior permanent officials and the College Governing Body. However, other parts of the L.E.A. machine frequently caused delays and frustrations. It was much easier to get approval for an X-ray set costing £1,000 than to get adequate lighting in a classroom or a laboratory, and several Senior Lecturers at £1,000 a year each could be obtained much more readily than a clerical assistant at £5 a week.

Some of the committees and sub-committees appeared to be most remote, and one was frequently conscious of the difficulty in stating a case which had to pass through several channels before reaching the body responsible for making the decision.

THE MINISTRY OF EDUCATION

The Ministry of Education provides two quite distinct sets of bosses for colleges. There are the H.M.I. and the Ministry itself, that vague impersonal body somewhere in London, which is concerned with decisions on all sorts of issues, from approval of courses to interpretation of the Burnham Report. As far as the Colleges are concerned, this is the body which usually says " No " when the wanted answer is " Yes," and which takes an unconscionably long time to say it. No doubt this is a very one-sided view of the Ministry but it is one commonly held in the Colleges.

H.M.I. are much more tangible masters. On the whole they are a helpful and friendly group of individuals, who frequently suffer from overwork. They have to deal with such a wide variety of subjects and establishments, that there is a real danger of them becoming experts on all sorts of subjects about which they know little or nothing. Fortunately most of them are aware of this danger. The L.E.A. and the " Ministry " frequently credit the H.M.I. with this omniscience. The H.M.I. can be, and frequently is, of immense value in the smaller colleges. In the larger colleges he serves the function of the liaison with his vague counterpart, the Ministry. Frequently, he finds it difficult to conceal his exasperation or disagreement with his counterpart.

PROFESSIONAL INSTITUTIONS

Many teachers in technical colleges get a good deal of inspiration and satisfaction through their membership of professional institutions. However, the latter, largely through their membership and examination committees and their joint committees for National Certificates, with the inevitable assessors, constitute some of the most exacting and annoying masters to whom the colleges have to pay homage.

From the point of view of the teachers the National Certificate assessor is frequently looked upon as the lowest form of inhumanity. Of course this view is completely false in the great majority of cases, and with the National Certificate scheme constituted as at present, some kind of assessment is essential. Perhaps it is the apparent omnipotence allied to anonymity of assessors that is so objectionable to teachers. There is much less dissatisfaction with the scheme in Applied Physics, which is more or less unique in that the assessors are known, and opportunities are occasionally provided for exchanging views with teachers. If it were possible for teachers and assessors to change roles periodically, no doubt there would be much more sympathy on both sides.

Membership committees of some of the professional bodies have recently created precedents by giving full recognition for membership purposes to certain technical college courses. It is to be hoped that others will follow suit. It is common practice for these committees to compare college courses with the institutions' examination syllabuses and give exemptions on a subject for subject basis. The reliability of such a process is open to considerable doubt. Surely the thing to do is to award exemptions to complete college courses on

the grounds of the known quality of the staff, the facilities and the standards. These are of much greater import than syllabus content.

In this collection of general grumbles one cannot miss the opportunity of a specific complaint against the graduateship examinations of The Institute of Physics. The standard of some of the papers is beyond that of some of the exempting qualifications, when allowance is made for the fact that this is an external examination. As a result the people who are obliged to take the graduateship examination are being penalized to some extent. Frequently they are among the less favoured members of the community to start with, on the grounds of opportunity or academic ability. When the graduateship examination was introduced it was hailed by many colleges as a valuable escape from external degrees. The results so far have shown that the degree offers a much easier entrance qualification, and the enthusiasm for the Institute's examination is on the wane. It may be that the new regulations for the London General Science degree which become operative in 1960 will redress the balance. The scales are indeed heavily weighted against the unfortunate part-time student.

I should like to conclude this particular grouse by emphasizing that I am not objecting to the high standard of the graduateship examination as such, but to the inconsistency in comparison with exemptions, particularly the second class honours General degree.

UNIVERSITY OF LONDON AND AWARDS

Through its external degree system the University of London has had a considerable effect on the work of technical colleges. In many ways this effect has been good, particularly as it has helped to raise and maintain standards. At the same time developments in the larger colleges have been severely restricted by external degree work. The London University courses have not been designed for technologists. Fundamental principles should form the basis of any scientific training but these principles can be taught just as well with a modern and applied outlook. In addition, all technologists, whatever their specialist interests, should have a broad background of related technologies. This can only be provided through courses which are designed for the purpose, and certainly not through General Science degrees in Physics, Pure Mathematics and Applied Mathematics. It is perhaps in the laboratories where the harmful effects of General Science degrees are most obvious. The courses usually consist of a selection of experiments which have been set in the practical examinations. It is not uncommon to find about twenty different methods of measuring elastic constants and nothing on alternating currents.

There is another way in which the University of London has had a restrictive effect on development. The teacher must have as his main objective the preparation of the student for the external examination. This is not necessarily the same thing as teaching basic principles or developing good mental habits.

In the writer's opinion the external degree has been one of the main causes of inefficiency in large technical colleges. Not only has it prevented the development of courses to meet the needs of industrial technology, but it has also encouraged the wrong type of work and the wrong type of student. For degree courses the technical colleges have employed lower entrance standards than the universities and, as a result, have had poorer recruits. Frequently, students are enrolled before they have satisfied the minimum university entrance requirements, and most technical colleges are overloaded with classes for G.C.E. "A" level subjects and even "O" level in some cases. The students in the main are lame dogs of one kind or another who are seeking an easy entry to a university or to a technical college degree course. Many of them fall by the wayside and very few enter technological courses. It may be mentioned in passing that the colleges encourage these classes since they increase the number of enrolments considerably. The total of student-hours is one of the main yardsticks in measuring the importance of a department or a college for grading and salary purposes.

For those who take final degree courses many colleges do not exert sufficient control on progress. Cases are quite common where students advance through the whole course having failed hopelessly at each stage, or sometimes without any assessment at all by the college.

The sooner those colleges with a fair volume of degree work take courage and develop independent courses, the nearer they will be to fulfilling their main function (the training of technologists), and the more likely they will be to find the freedom and the status that they desire. An excellent opportunity is available at present through the sandwich courses which are being introduced, provided these are confined to the larger and better colleges, and the standards are set at a level at least comparable to a degree. It may be that the award to be given by the new national body under Lord Hives will provide a satisfactory alternative to the external degree, by ensuring an adequate standard based on internal assessment. It is to be hoped that this body and its Boards of Studies will not merely be another set of masters and advisers to harass the colleges.

BURNHAM COMMITTEE

As the body responsible for the fixing of salaries the Burnham Committee has an indirect but all-important influence on the technical colleges. There are representatives of the Association of Teachers in Technical Institutions on the committee but, since the majority of the members of the A.T.T.I. are from smaller colleges, it is doubtful if an adequate case is put forward on behalf of the few major colleges concerned with higher technological education. The present salary scales are sufficient to attract capable younger men at the Lecturer grade, but the Senior Lecturer scale is quite inadequate for recruiting or retaining good men with experience. The Burnham scale as a whole wants considerable revision but its outstanding weakness for the major colleges is the large gap between Senior Lecturer and Head of Department (i.e. assuming a large college and Grade V departments). The introduction of another scale at about £1,500 per annum would prevent the loss of good Senior Lecturers to the headships of smaller colleges, and would also encourage more recruitment from industry. The importance of the right kind of industrial experience amongst the teaching staff can hardly be over-emphasized. With the present salary scales recruits from industry are in many cases the mediocrities.

If and when new and better salary scales are introduced it is to be hoped that they will be used mainly to encourage only the best teachers already in the colleges, and to attract new recruits of the right calibre from outside. The 1951 Burnham awards were abused in some cases by giving higher salaries to teachers who did not always merit them.

ALL THE REST

It is not proposed to discuss in detail the shortcomings of all the other bosses and "advisers" such as the examining unions, the advisory councils and the governing bodies. The first of these is a mixture of the external examiner and the assessor, and quite a good case can be made out for it. The Regional Advisory Councils are sound in principle and could be of real value for co-ordination. Unfortunately, they frequently advise on and attempt to co-ordinate events that have already occurred. There is much to be said for the College Governing Bodies and these are bosses which should be encouraged. All too often they are merely rubber-stamping bodies.

RESEARCH IN TECHNICAL COLLEGES

In one or two college departments serious attempts are being made to do some original research work. The effect of this on the vitality and the status of a department can hardly be over-emphasized. There are many heresies and misconceptions on the subject of research, and a few personal opinions are offered for what they are worth. Firstly, excessive teaching hours and lack of accommodation need not preclude research. A sufficiently strong urge will overcome these difficulties somehow. This, of course, is not being put forward as an excuse to be used by recalcitrant principals, heads of departments, or L.E.A. to refuse time or

facilities for research. In the writer's department certain members of staff had class-contact hours (i.e. total time spent on lectures, laboratories and tutorials, but excluding research or research direction) of about eight hours. This gave considerable time for research. Provision of this type should only be made for people of proved research ability.

In order to start up a research project it is highly desirable to have in the department someone with research experience, and preferably with good general knowledge of the field of the project. So many attempts " to do research " have been made in colleges and have failed, owing to lack of background and guidance. The techniques of original investigation have little in common with the set experiments of most laboratory courses, and one would find it difficult to imagine a poorer preparation for research than the average technical college laboratory course. Herein lies one of the main arguments in favour of research work in colleges.

Adequate workshop facilities and staff are essential parts of any experimental research programme.

CONCLUSION

In these comments on technological education emphasis has been laid on numerous shortcomings. The writer presumes to conclude with a number of recommendations which he believes would alleviate some of the shortcomings.

(*a*) Elimination of some of the many bosses is essential. Genuine Governing Bodies with freedom of control within an agreed maximum expenditure would be one improvement, thereby eliminating largely the L.E.A. and the Ministry of Education from any direct control. The Central Institutions in Scotland financed by the Scottish Education Department go some way towards this objective, at least as far as the L.E.A. control is concerned. The L.E.A. are represented on the Governing Bodies.

(*b*) Major Colleges should be taken outwith the aegis of the Burnham Committee. Definition of " major college " is difficult, but at present there are probably no more than half a dozen or so in England and Wales which are of sufficient standing to be so described.

(*c*) All professional institutions should give full recognition to approved college awards for membership purposes.

(*d*) The colleges should shed elementary irrelevant classes, and purge themselves of the student-hour complex.

(*e*) External degree courses should be discontinued and colleges should develop courses of degree standard specifically for technologists.

Reviews of Books

GENERAL SCHOOL PHYSICS. Vol. I. Heat and Light.

By R. Stone, M.A., A.Inst.P., N. Bronner, M.A., and J. Lawrence, S.J., M.A., B.Sc.

London : English Universities Press Ltd. Pp. 374. Price 9s. 6d.

This book is the first of the " Grammar School Series " of Science Texts edited by R. Stone, Senior Science Master of Manchester Grammar School, and with its companion volumes of Mechanics and Sound, and Magnetism and Electricity, forms a General School Physics Course up to the Ordinary and Ordinary Alternative levels of the main G.C.E. examining boards.

Every attempt has been made by the authors to present the text in an attractive manner to the Middle School pupil and present day applications of physical principles are stressed and illustrated, wherever possible, by good half-tone plates.

A prominent feature of the book is the bold, clear printing of definitions and diagrams, the latter having captions designed to stimulate thought about the diagram. In no case is a diagram too complex to allow of its reproduction as part of the answer to an " O " level examination question.

In the section on Heat the very full treatments of Expansion and of Heat and Mechanical Energy are particularly commendable. It is, however, in this section that I feel that a clearer picture of what is meant by experimental error should be given to the pupil. Such loose expressions as " the experiment will only be accurate to 1 or 2% " (p. 105) and " the accuracy will not be better than 2% " (p. 107) are very misleading to the elementary student and can only cause confusion of ideas. Also I note that in an experiment to determine the Latent Heat of Vaporization of water by the simple mixture method a raw result of 541·1 calories per gram was obtained. Appreciating that this is subject to at least two per cent error the author quotes the result as 540 cal. per gram. Surely it would be better to explain that all the experiment has done is to show that L probably lies within the range 541 ± 10 cal. per gram ! I think this is not too difficult for a Middle School boy to appreciate and it is good training for later work.

In the Optics section of the book the emphasis is on graphical solutions to all the usual reflection and refraction problems. The " Real-is-Positive " sign convention is used and is presented so clearly by these graphical methods that the pupil should have a good general understanding of what is happening before he embarks on algebraical methods of solving lens and mirror problems. My only criticism in this section is that the proof of the formula for the equilateral prism at minimum deviation has been omitted. Surely this is well within the geometry of Middle School and is much simpler to grasp than the proofs of the reciprocal formulae which are included in the text ?

The examples at the end of each chapter have been carefully graded into two groups ; the first for use in the early part of a physics course, and the second consisting of harder examples taken from papers of the various examination boards.

A feature which appealed to me very much is the provision of three figure logarithm and trigonometrical tables inside the back cover of the book. These are very easy to use, are very compact, and are quite accurate enough for simple problems and school experiments.

This book is obviously the result not only of considerable teaching experience but of much careful work in presentation and in the provision of a good foundation for further studies. I can commend it to all concerned with physics teaching in our schools.

W. B. Chivers.

GENERAL SCHOOL CHEMISTRY

By S. Clynes and D. J. W. Williams

London : English University Press. Pp. 620. Price 12s. 6d.

This textbook forms part of a series planned to cover the Ordinary and Ordinary Alternative syllabuses of the General Certificate of Education and is also intended to form a basis for more advanced work. The authors state that their approach " in general covers conventional and well-tried lines." Although this is true, they have brought the treatment of conventional material up to date in a lucid manner. They have also taken pains to illustrate the subject-matter by frequent reference to modern chemical and metallurgical industry. Theoretical parts of the subject are carefully and clearly explained, and there are instructions for many experiments. The book is attractively produced with plenty of clear diagrams, summaries in tabular form and questions at the ends of most chapters. Although full of good material this is in no sense a " cram " book, and is extremely good value for 12s. 6d.

G. Van Praagh.

PRACTICAL METROLOGY : Vol. II.

By K. J. Hume, B.Sc., M.I.Mech.E., M.I.Prod.E., and G. H. Sharp

London : Macdonald & Co. (Publishers) Ltd. Pp. 71 + xvii. Price 7s. 6d.

Volume II in the planned series of four instructional manuals provides, like its predecessor published in 1953, a collection of twelve laboratory experiments in engineering dimensional metrology. The experiments described correspond to actual examples encountered in precision engineering practice and are typical of the more advanced work required from students taking metrology as a subject for a National Certificate.

Each experiment gives detailed instructions for its performance as well as for recording and assessing the results obtained, particular reference being made, where applicable, to the relevant B.S.I. specifications. The experiments include the measurement of plain and taper plug gauges, a spur gear, plug and ring screw gauges, the checking of form plate gauges, by optical projection and the verification of a sine bar. An appendix provides tabulated data required in the measurement of screw threads. Some reference is made to the N.P.L. " Notes on Applied Science," No. 1, *Gauging and Measuring Screw Threads*, and this, as well as No. 5 in the same series, *Gauge Making and Measuring*, would provide valuable background information to the practical course.

The manual is well produced but is marred by evidence of lack of careful proof reading, and there are one or two instances of engineering jargon which were better avoided in a manual for students. Nevertheless, Vol. II may be recommended for use in continuation of the course on practical metrology. This is quite evidently based on a good knowledge of the requirements of students and it is to be hoped that publication of the succeeding volumes will not be so long delayed as Vol. II.

H. Barrell.

EXERCISE IN PRACTICAL PHYSICS

By N. Nelkon, M.Sc., A.K.C.

London : W. Heinemann Ltd. Pp. 36. Price 2s. 6d.

This is a small handbook giving the titles, apparatus required, and brief hints for a course of 72 experiments similar to those set in the Practical Physics papers at Advanced Level (Intermediate) of the various G.C.E. Examining Boards.

Much space is given to rather crude diagrams of the apparatus used in each experiment. These appear to me quite pointless as by the time a boy has started on "A" level work he should know how to draw a simple electrical circuit employing standard symbols, how to convey to an examiner the general lay-out of his apparatus and to recognize all the normal apparatus of a school physics laboratory.

This book does not replace a proper laboratory manual nor the more usual technical instruction sheets but it does contain some useful revision material.

W. B. Chivers.

MANUAL OF CIVIL DEFENCE. Vol. I, Pamphlet I: Nuclear Weapons

London: Her Majesty's Stationery Office. Pp. 55 + iv. Price 2s. 6d.

In the official *Manual of Civil Defence* this important little book forms Volume I, Pamphlet No. 1—an appropriate classification for, of all the problems now confronting the authorities responsible for our national safety, that of defence against nuclear weapons is surely the most formidable.

A general account of the events following a nuclear explosion is followed by detailed estimates of the damage produced by a 10-megaton hydrogen bomb, based on the U.S. Atomic Energy Commission's report after the Bikini test in March, 1954. The construction of the bomb is not mentioned explicitly but confirmation is provided for the speculations of Dr. Ralph Lapp and Professor Joseph Rotblat, suggesting that the fall-out from such a weapon is largely due to fission in a uranium jacket surrounding the explosive core.

The pamphlet frankly acknowledges the hopelessness of any defensive measures against the blast from a 10-megaton bomb, for the crater is expected to be a mile in diameter and the area of total destruction is 7–8 miles across. Far outside these limits, a tract 50 miles wide may be polluted by radioactive dust; some suggestions are offered on the construction of refuge rooms and slit trenches.

Physicists will welcome the book as a useful collection of data—and some of its 35 illustrations will make excellent lantern slides.

J. M. A. LENIHAN.

ATOM HARVEST

By Leonard Bertin

London: Secker and Warburg. Pp. 253. Price 20s.

In this book, the science correspondent of the *Daily Telegraph* tells the story of the British Atomic Energy project. The fundamental researches which led to the discovery of nuclear fission are briefly described, usually in the form of anecdotes about the actual discovereies and those who made them. The author then turns to the beginnings of the wartime work initiated in this country by G. P. Thomson through the Maud Committee, and later continued as the Tube Alloys Project. He discusses the early British-American collaboration on atomic energy matters and waxes indignant over the U.S. decision in the autumn of 1942 to withdraw from further collaboration.

The Anglo-Canadian project at Chalk River, the development of the Atomic Energy Research Establishment at Harwell and the setting up of the British production reactors and separation plants are very interestingly described, with the emphasis always on personalities rather than processes. The scientific background provided is, however, adequate for the layman with some technical and engineering knowledge and the popular explanations are usually well done.

The latter part of the book deals with the British atomic bomb tests of 1952 and 1953, with the uses of isotopes in biology and medicine and with the hazards attendant upon both peaceful and military uses of nuclear energy. In these latter fields the author seems less at home than in the earlier chapters and small errors are not infrequent. For instance, a person who spends half his time in the open exposed to fall-out radiation from bomb tests and half his time indoors where the protection factor is twenty will receive 21/40 of the "open air" dose, not 1/10 as implied on page 220. The estimate of ·003r per generation which is referred to there must be based on only 10% "open air" exposure.

The author's ready acceptance of the thesis that H-bombs can act as a "shield" for Britain is a little too conventional to be acceptable to all readers, as are some of the political views expressed or taken for granted. The main interest throughout the book, however, is the inside history of the atomic energy project, and this is told with considerable journalistic skill in the form of interviews with the principal personalities involved. Although the book is evidently aimed at the layman, it will also be read with interest by many of those now working in the atomic energy field.

J. W. BOAG.

Vol. 7, April, 1956

Report of the Board of The Institute of Physics for the year 1955

TO BE PRESENTED FOR ADOPTION AT THE ANNUAL GENERAL MEETING OF THE INSTITUTE ON JULY 16, 1956

The Board and its Committees

The present Board took office on October 1, 1955 ; its members on December 31, 1955, were :

President : Sir John Cockcroft.

Immediate Past-Presidents : Prof. W. E. Curtis, Dr. C. Sykes.

Vice-Presidents : Mr. O. W. Humphreys, Mr. G. R. Noakes, Dr. W. H. Taylor, Prof. F. A. Vick.

Honorary Treasurer : Dr. S. Whitehead.

Honorary Secretary : Dr. B. P. Dudding.

Ordinary Members of the Board : Dr. H. Barrell, Dr. P. S. H. Henry, Dr. M. R. Hopkins, Dr. J. M. A. Lenihan, Dr. K. A. G. Mendelssohn, Mr. A. T. Pickles, Mr. H. P. Rooksby, Dr. J. Taylor.

Chairman of Branches in Great Britain : Prof. E. A. Owen (Liverpool and North Wales), Dr. J. S. Forrest (London and Home Counties), Dr. R. W. Sillars (Manchester and District), Prof. P. B. Moon (Midland), Prof. W. E. Curtis (North Eastern), Dr. J. M. A. Lenihan (Scottish), Mr. R. G. Wood (South Wales), Prof. W. Sucksmith (Yorkshire).

Representing The Physical Society : Dr. H. H. Hopkins and Mr. A. J. Philpot

During the year the Board met six times and appointed the undermentioned Standing and Executive Committees which held seventeen meetings.

Finance and General Purposes Committee (*Chairman :* The Treasurer).

Membership Committee (*Chairman :* Mr. H. P. Rooksby).

Education Committee (*Chairman :* Dr. W. H. Taylor).

Benevolent Fund Committee (*Chairman :* Dr. S. W. Whitehead).

Advisory Committee of the British Journal of Applied Physics (*Chairman:* Dr. T. E. Allibone).

Advisory Committee of the Journal of Scientific Instruments (*Chairman :* Dr. H. Barrell).

Conference on "The Physics of Nuclear Reactors" — London, 1956 (*Chairman :* Dr. T. E. Allibone).

Third Convention—Oxford, 1957 (*Chairman :* Dr. J. Topping).

Representatives and Nominees on Joint Committees and other Bodies

The Institute has been represented as follows and summaries of the principal work of those bodies likely to be of interest to members are given in the appendix to this Report.

On the Royal Society's National Committee for Physics : Prof. F. A. Vick.

On the Royal Society's National Committee for Crystallography : Dr. W. H. Taylor.

On the Royal Society's Paul Instrument Fund Committee : Sir Frank Smith.

On the Board of The British Nuclear Energy Conference : The President, Mr. O. W. Humphreys, and Dr. H. R. Lang.

On the Joint Council of Professional Scientists : Prof. W. E. Curtis, Dr. S. Whitehead, and Dr. H. R. Lang.

On the Parliamentary and Scientific Committee : Dr. B. P. Dudding and Dr. H. R. Lang on the General Committee, together with Dr. J. S. Forrest and Dr. S. Whitehead at the Annual Meeting.

On the Committee of Management of Science Abstracts : Mr. E. R. Davies.

On the Council for Diplomas in Technology's Board of Studies for Technologies other than Engineering : Prof. F. A. Vick.

On the City and Guilds of London Institute's Advisory Committee on Courses for Laboratory Technicians : Mr. N. Clarke, Mr. T. H. Tyler and Mr. L. Walden.

On the City and Guilds of London Institute's Advisory Committee on the Training of Instrument Mechanics and Technicians : Mr. N. Clarke.

On the City and Guilds of London Institute's Advisory Committee on Industrial Radiography : Mr. N. Clarke, Mr. F. Y. Poynton and Mr. W. E. Schall.

On the Joint Committee with the Ministry of Education for National Certificates in Applied Physics : Dr. J. S. Forrest, Mr. A. E. De Barr, Mr. A. T. Pickles and Dr. J. Topping.

On the Joint Committee with the Scottish Education Department for National Certificates in Applied Physics : Mr. T. H. O'Beirne, Dr. R. S. Silver and Dr. A. G. White.

On the British Committee for Radiological Units : Mr. W. Binks.

On the Joint Committee (with the American Society for Testing Materials and The American Crystallographic Association) for Chemical Analysis by X-ray Diffraction Methods : Prof. A. J. C. Wilson.

On the Joint Committee of Technical Institutions and Societies in Great Britain on Materials and their Testing : Mr. W. E. Schall.

On the Physics and Mathematics Advisory Committee of the Technical and Scientific Register of the Ministry of Labour : The President and Dr. H. R. Lang.

On the London Regional Advisory Committee on Applied Physics : Mr. N. Clarke, Mr. F. Y. Poynton and Mr. G. W. Warren.

On the Court of Governors of the Manchester College of Science and Technology : Sir John Cockcroft.

On the Court of the University of Hull : Dr. E. C. Craven.

On the Governing Body of Croydon Technical College : Mr. C. L. S. Gilford.

On the Governing Body of Norwood Technical College : Dr. A. J. Maddock.

On the Advisory Sub-Committee for Electrical Engineering and Applied Physics of Cardiff College of Technology and Commerce : Mr. R. G. Wood.

On the Sub-Committee on Specialist Courses in Electrical Engineering of the Welsh Academic Board of Technology : Mr. W. S. Vernon.

On the Consultative Committee for Electrical Engineering and Applied Physics of the South East London Technical College : Dr. C. G. Wynne.

On the Applied Science Advisory Committee of the Royal Technical College, Salford : Mr. D. A. Crooks.

On the Science Advisory Committee of the Ipswich School of Technology : Mr. H. A. Nancarrow.

On the Science Advisory Committee of Blackburn Technical College : Dr. A. Hargreaves.

On the Science Advisory Committee of Bury Municipal Technical College : Mr. H. Potter.

On the Science Advisory Committee of Croydon Technical College : Mr. S. Hill.

On the Applied Science Advisory Committee of the Wolverhampton and Stafford Technical College : Dr. W. Betteridge.

On the Science Advisory Committee of Luton and South Bedfordshire College of Further Education : Dr. R. W. Williams.

On the Science Advisory Sub-Committee of Poole College for Further Education : Mr. C. F. Oxbrow.

On the Science Sub-Committee of the Eastern Area Technological Committee of the East Anglian Regional Advisory Council for Further Education : Mr. H. A. Nancarrow.

On the Yorkshire Council for Further Education Advisory Panel for Applied Physics : Mr. S. L. Anderson, Dr. K. W. Andrews, Dr. M. O. Pelton and Mr. E. Wilfred Taylor.

On the Bucks County Education Committee, Slough Area Science Advisory Committee : Mr. J. Yarwood.

On the Regional Council for Further Education for the South West : Prof. S. H. Piper.

On British Standards Institution Committees : The Institute has been represented on twenty-five committees of the B.S.I.

General Meetings

The 25th Annual General Meeting of the Institute was held on May 17 in the Institute's House.

Election of Honorary Fellow.—At the meeting on May 17 Sir James Chadwick was declared elected an Honorary Fellow.

Changes in By-Laws.—An Extraordinary General Meeting of the Institute was held on October 4 when amendments to By-Law

Table 1. *Changes in the Register during 1955*

	Total on Dec. 31, 1954	*Elections*			*Resigned*	*Deceased*	*Removed*	*Transfers from*	*Net Increase or Decrease*	*Total on Dec. 31, 1955*
		New	*Transfers to*	*Re-admitted*						
Hon. Fellows	5	—	1	—	—	—	—	—	+ 1	6
Fellows ...	974	14	35	1	1	9	1	1	+ 38	1012
Associates ...	1853	98	104	1	12	1	1	34	+155	2008
Graduates ...	953	165	91	—	15	—	—	103	+138	1091
Subscribers...	453	29	1	—	16	3	—	3	+ 8	461
Students ...	511	162	—	—	14	—	—	91	+ 57	568
TOTAL ...	4749	468	232	2	58	13	2	232	+397	5146

44 were approved. These concerned the rights of members to receive copies of the Institute's scientific Journals without payment additional to their annual fees.

Membership

During the year 726 applications for election or transfer to the various grades were received for submission to the Membership and Examinations Committee, compared with 579 applications in 1954. The numbers for the grades (with the 1954 numbers in brackets) were : Fellows 62 (48), Associates 213 (179), Graduates 244 (225), Students 171 (93) and Subscribers 36 (39). Representatives of the Committee visited seven technical colleges, which had applied for recognition or a continuance of recognition by the Institute for the purpose of its membership regulations. The degrees of the University of Malaya were recognized.

Deaths.—The Board records with regret the deaths reported in 1955 of :—

Fellows : Dr. W. W. Barkas, Mr. E. W. Bliss, Dr. W. J. R. Calvert, Mr. C. Croxson, Dr. T. Evans, Mr. G. H. Martyn, Sir Richard Paget, Dr. W. G. Shilling, Dr. E. Schwarz, Dr. W. S. Tucker. *Associates :* Dr. H. Chatley, Mr. W. M. Holmes. *Subscribers :* D. E. Fletcher, Mr. J. E. Thompson, Mr. C. Whiteley.

Examinations

Graduateship Examination.—The Graduateship Examination was held on June 20–23. Written papers were taken at the Institute's House, the College of Technology, Birmingham, Paisley Technical College and the Royal Technical College, Salford. The practical examination was held at the Polytechnic, Regent Street, London. The papers were published in the October *Bulletin* with the comments of the Examiners and were subsequently published in pamphlet form.

Eighty candidates were accepted but twenty-six withdrew, mainly requesting a transfer of their applications to the 1956 examination. Of the remaining fifty-four candidates, eleven satisfied the examiners in those papers which they were required to take. Ten question papers were set. The Examiners were : Professor J. G. Wilson, Professor F. A. Vick, Dr. J. Topping, Mr. A. E. De Barr, Mr. J. Yarwood, and Mr. N. Clarke. Professor H. Lipson has been appointed to be an Examiner for 1956 in place of Professor F. A. Vick.

National Certificates in Applied Physics.—The number of candidates taking the final examination for National Certificates in Applied Physics was 309 at the Ordinary level and 82 for the Higher Certificate. These figures compare with 206 and 75 respectively in 1954. The Institute's assessors were : Dr. J. Topping, Mr. G. W. Warren and Professor J. D. Craggs for England and Wales and Dr. G. Morris for Scotland.

Education

Higher Technological Education.—The Board has continued to comment upon and support proposals for the development of facilities for Higher Technological Education. It accepted an invitation from the Ministry of Education to nominate a member to one of the two Boards of Studies set up to advise the newly appointed National Council for Diplomas in Technology.

Recognition of College Diplomas.—Three technical colleges—Acton Technical College, Birmingham College of Technology and Northampton Polytechnic, London — announced the establishment of new "sandwich" courses in physics leading to the award of college diplomas and the Board was requested to recognize these diplomas as carrying complete exemption from the Institute's academic requirements for Graduateship and corporate membership. This recognition was granted subject to the agreement of the college authorities that external examiners would be appointed with powers similar to those of university external examiners and that the appointments would be subject to the approval of the Institute. Subsequently two further colleges requested similar recognition for diplomas to be awarded on successful completion of full time courses in physics. These two requests (from The Polytechnic, Regent Street, London, and Brighton Technical College) were agreed on similar terms. The Board has in the past expressed its strong opinion that the major technical colleges should be developed and should be given academic and financial autonomy; the Institute's recognition of awards for which the colleges themselves have complete responsibility is a tangible expression of this view.

Availability of places for physics students in universities and technical colleges.—Arising from concern felt at the increasing evidence of declining numbers of advanced students in the physics departments of several well-equipped technical colleges, the Board decided to institute an enquiry into the availability of places for students of physics in the universities and larger technical colleges of the country. There was a good response to the inquiry for information, and the report giving the data obtained and the Institute's comments upon them was published in the *Bulletin* in September, reprints being widely circulated. The report was noticed and commented upon in the technical and scientific press.

Careers in Physics.—Many requests have been received from sixth form school boys and girls in the sixth form, their parents or teachers, for information about careers in physics, and have been dealt with. The Deputy Secretary has addressed meetings on this subject in Bristol, Edinburgh, Ewell, Glasgow, Aberdeen and Swansea.

Publications

The Journals.—Both the circulation and the advertisement revenue of the *Journal of Scientific Instruments* and of the *British Journal of Applied Physics* again increased satisfactorily. Unfortunately costs of production continued to rise with consequent restrictions.

The amount of material submitted and published in 1955 is shown in Table 2, together with the corresponding figures for 1954. As more papers were published than accepted during the year the average delay between the submission and publication of acceptable scripts was slightly reduced.

Again the Board welcomes this opportunity of thanking those Fellows and others who have refereed papers or reviewed books or assisted the Editor in other ways.

At its annual meeting the Advisory Committee of the *Journal of Scientific Instruments* expressed the view that "the contents and scope of the Journal were satisfactory and of a sufficiently high standard" and it advised the Editor on a number of technical and other details.

In its annual report to the Board the Advisory Committee of the *British Journal of Applied Physics* expressed satisfaction with the content, scope and standard of the papers and articles. This Committee considered some border line subject papers, which the Editor had referred to it to help to define the journal's scope. The Committee wished it to be widely known that while 3,000 words was the median length of accepted papers, none would be rejected on account of length alone. The fourth Supplement to this Journal was published as part of the 1955 volume. It contained the proceedings of the Electronics Group's Symposium held in Cambridge in April, 1954, on "Luminescence with particular reference to inorganic phosphors."

The Board expresses its thanks to the Scientific Instrument Manufacturers' Association of Great Britain Ltd. for again donating

Table 2. *Contributions submitted and published*

	J.S.I.		*B.J.A.P.*	
	1955	1954	1955	1954
Extent of Journal text (pages)	508	*488*	462 + 120 (Supplement)	*466 + 218* (Supplement)
Original papers (numbers) :				
Submitted	144	*180*	122	*102*
Accepted	111	*121*	88	*66*
Published	117	*137*	97	*79*
Special Articles and Conference Reports published (numbers)	5	*3*	7	*15*
Laboratory and Workshop Notes (numbers) :				
Submitted	93	*60*	—	—
Accepted	68	*53*	—	—
Published	64	*78*	—	—
New Instruments, Materials and Tools :				
Items published	43	*40*	—	—
Notices of manufacturers' publications	12	—	—	—
Letters to the Editor published	27	*25*	14	*14*
New Books :				
Number of reviews published	23	*23*	88	*92*

£50 from its Bowen Trust Fund for prizes for the best original contributions from authors under 35 years of age, relating to scientific instruments or their use published in either of the Institute's Journals.

Bulletin.—The twelve monthly issues consisted of 300 + lxxviii pages compared with 240 + xlvii pages last year. Fourteen articles, some of them invited contributions and others based upon lectures given to the Education Group, were published together with the usual news of Branch and Group activities, lists of new elections and other notices of interest to members. Reviews of 27 books were published and a total of 403 advertisements for physicists or technicians were included (compared with 214 in 1954). Many expressions of members' approval of the development of the *Bulletin* were received and the Board decided to carry this development further. Commencing in 1956, the *Bulletin* will be the only periodical to which all members will be entitled without extra payment, and it is to be issued in new and improved form. Towards the end of the year the plans for the new issue were completed.

Books and pamphlets.—The two volumes in the *Physics in Industry* series which were unavoidably delayed last year were published during the year. They were the ¼-million word book entitled "*X-ray diffraction by polycrystalline materials*" to which 31 members of the Institute's X-ray Analysis Group contributed. The General Editors were Mr. H. S. Peiser, Mr. H. P. Rooksby and Professor A. J. C. Wilson. The other volume was Mr. H. J. Woods' *Physics of fibres.*

Three small books were added to the *Student Monograph* series, namely Mr. E. W. H. Selwyn's *Theory of Lenses*, Dr. H. L. Penman's *Humidity*, and Dr. J. Topping's *Errors of observation and their treatment.*

A report entitled *The availability of places for physics students in Universities and Technical Colleges* was published in September and consisted of statistical data, together with comments of the Education Committee and the Membership and Examinations Committee on these data.

Professional Matters

The permanent Officers have again dealt with a regular flow of inquiries on professional matters and the Board expresses its thanks to the several Fellows who have assisted them with expert advice. Among the most common requests are those for an

opinion on the terms of service contracts ; and while no attempt is made to give a legal opinion members are advised if the clauses appear to be in the usual form. The number of requests for consultants is increasing, especially in connexion with litigation ; but it is not always possible to find members able and willing to act as expert witnesses. There is now a regular procedure for dealing with deferment from military service and the Institute issues certificates of recommendation to those following approved courses for its Graduateship examination and advises the Ministry on the deferment of those studying for the Higher National Certificate in Applied Physics.

The salary statistics published by the Institute prompt inquiries. The excellent response from members to the request for data for the periodical salary inquiries has made the Institute a recognized place for employers and employees to inquire about appropriate salaries; and the ability to give guidance in the light of these data is believed to react often to the advantage of physicists.

Nuclear Energy

British Nuclear Energy Conference.—The need for a recognized permanent body in this country before which papers on the application of nuclear energy and ancillary subjects could be read and discussed was the subject of negotiations initiated by the major Engineering Institutions. As a result a body known as the " British Nuclear Energy Conference " was formally inaugurated at a meeting in London on November 30. This organization provides for joint consultation between its constituent bodies about conferences, symposia, lectures and so forth, and is to have its own Journal. The founding constituent bodies, each of which has three representatives on the governing Board, are the Institutions of Civil, Mechanical, Electrical and Chemical Engineers and The Institute of Physics.

The Board of the Institute welcomed this further opportunity of collaboration with the Engineering Institutions in this important field, and agreed to the financial and other obligations involved.

Geneva Conference. — At its meeting on October 4 the Board of the Institute unanimously resolved as follows :—

> " That it be recorded in the minutes of this Board that it has noted that the British physicists, under the leadership of the President, played a prominent part in the recent United Nations Conference on ' The peaceful uses of atomic energy,' and is happy to see this further contribution to one of our Institute's principal objects, namely, the advancement and diffusion of a knowledge of physics, pure and applied."

The Institute's House

Increased rent.—During the year the Board had before it on several occasions reports on the protracted and complex negotiations over the lease of the House, in which no less than four lawyers and four surveyors were involved on behalf of various interests. Although it was uncertain whether the rent could in fact be increased, the Board preferred to settle by negotiation rather than take the matter to Court. Many possibilities were considered, including the seeking of alternative accommodation, but eventually the Board agreed to an increase of rent from £735 p.a. to £1,525 p.a. from midsummer 1955 until 1983. The new arrangements require a new lease between the Grosvenor Estate (the ground Landlords) and Lord Mount Edgcumbe's Estate, of which the Institute is sub-tenant. At the end of the year these agreements were being prepared.

Repairs and decorations.—Owing to the uncertainty reported above and the need for economy, only essential repairs and decorations were carried out during the year.

Meetings.—The number of meetings held in the House during the year compared with the previous year is given in Table 3 :

Table 3. *Meetings held in the House*

Institute meetings	1955	*1954*
Board and Committee meetings (including Branch and Group Committees) -	76	*78*
Conferences and Lecture meetings - - -	45	*33*
Social functions - -	6	*8*

Other meetings	1955	*1954*
The rooms have also been used by other bodies as follows :		
Committee meetings -	17	*21*
Lecture meetings -	8	*9*

Conferences

Branch and Group Conferences.—The various conferences arranged by individual Branches or Groups are mentioned in that section below.

Annual Conference of Branch and Group Officers.—The twelfth annual Conference of Honorary Officers of Branches and Groups was held at the Institute's House on July 13, the Honorary Secretary, Honorary Treasurer and 26 Honorary Officers of the Branches and Groups being present. The main item of discussion was the proposals of the Finance Committee for increasing the Institute's income. These were generally approved and recommendations were agreed for submission to the Board. In addition various matters of administration were discussed.

Conference on Combustion.—The Institute accepted an invitation from the Institution of Mechanical Engineers to be one of the several collaborating bodies at a Conference on Combustion.

Conference on The physics of nuclear reactors.—The organization of the large Conference on " The physics of nuclear reactors " planned for July, 1956, was well forward by the end of the year under review.

Third Institute Convention. — The Board authorized the holding of a third Convention and approved that it take place in Oxford in July, 1957. An Organizing Committee was set up and held two meetings.

Miscellaneous

Canadian Physicists.—Cordial greetings were exchanged between the Presidents on the occasion of the Tenth Annual Congress of the Canadian Association of Physicists, which was held in Toronto.

American Institute of Physics.—The Secretary has again kept in touch with the permanent Officers of the American Institute. At their request a joint inquiry with The Physical Society was made about the likely demand for English translations of Russian papers on pure and applied physics.

Acknowledgments

Branch, Group and Conference Officers.—The Board wishes to record its thanks to those members who have acted as Honorary Officers of the Institute's Branches, Groups and Conferences and who have thereby contributed greatly to the Institute's activities.

Meeting Rooms and Visits.—The Board records its thanks to the many bodies which have generously allowed meetings of the Institute and of its Branches and Groups to be held on their premises or which have allowed visits to their laboratories.

Finance

The accounts are presented in the usual form with the same proportional allocation between them of the costs of running the House and the offices, as has been used since 1952. Taking the Institute's affairs as a whole, i.e. combining the Trust Fund account with the Institute's own account, there is a final surplus of £460.

The Institute of Physics Accounts

In previous reports it has been stressed that from time to time funds will have to be transferred from this account to the Endowment Trust Fund account so that members' subscriptions bear part of the cost of the Institute's educational and scientific work, including Branch and Group meetings, which would otherwise be borne almost entirely by the surpluses from the publications business. A sum of £5,000 has been so transferred this year, and the Fund has been kept at a nominal figure of £100 by carrying forward a deficit of £150.

Endowment Trust Fund Accounts.

The publications business, which forms the major part of this account, again had a satisfactory year.

The X-ray Index Fund, now standing at over £12,000, is referred to under the X-ray Analysis Group's Report. It is held in trust for that Group to finance the work in this country on the index. Steps have been initiated to establish a separate Trust Fund so that this large item can be transferred to a separate account.

Of the £9,765 shown on the balance sheet as Bank balances £5,500 is on deposit, and it is expected that it will be called for during 1956 to meet printing bills, since this money may largely be regarded as Journal subscriptions in advance.

Benevolent Fund

The Committee expresses its thanks to those members who have subscribed to the Fund during the year and to those responsible for the books, the royalties from which are credited to the Fund.

A first payment of £350 from the Trust established under the will of the late Mrs. W. Phillips was received and accounts for the major part of the increase in the Fund's income.

Fortunately the calls on the Fund have again been small so that a further £751 has been added to the modest capital which needs to be substantially increased if the Fund is to be effective in bad times.

Allowances were made in seven instances, of which four were new cases.

Activities of the Branches and Groups

Australian Branch.—President : Professor L. G. H. Huxley. *Vice-President:* Dr. F. W. G. White. *Honorary Secretary :* Associate Professor E. O. Hercus. *Honorary Treasurer :* Dr. J. S. Rogers. (427 members.)

The Divisions of the Branch in the different states have again held many meetings. An exhibition of Scientific Instruments and apparatus was held in Sydney from November 22–24 and was well attended.

Liverpool and North Wales Branch.—Chairman : Professor E. A. Owen. *Honorary Secretary :* Professor J. D. Craggs. (160 members.)

A most successful inaugural meeting was held in Liverpool on May 19 and three other lecture meetings were held in Liverpool in the autumn.

London and Home Counties Branch.—Chairman: Dr. J. S. Forrest. *Honorary Secretary :* Mr. B. S. Cooper. (2,350 members.)

Five lectures were held in London. An "At Home" was held in the Institute's House in October and was well attended by members and their guests. Visits to the Research Laboratories of Kodak Ltd., in April, and the Central Electricity Research Laboratories and British Coal Utilization Research Association in November were arranged. The Summer Meeting was held at the National Institute of Oceanography, Wormley, Surrey.

Manchester and District Branch.—Chairman : Mr. W. J. Meredith succeeded by Dr. R. W. Sillars. *Honorary Secretary :* Dr. D. G. Drummond. (353 members.)

Six lectures were held in Manchester. A visit to the Physics Department of the University College of North Staffordshire in April was arranged. A summer visit was paid to Messrs. Ferodo Ltd., Chapel-en-le-Frith, on June 22. A Branch Dinner was also held.

Midland Branch. — Chairman : Dr. W. Betteridge succeeded by Professor P. B. Moon. *Honorary Secretary :* Dr. R. J. Wakelin. (486 members.)

Seven lectures were held, one of which was held jointly with the Electronics Group. Visits to the University of Birmingham in April and the Atomic Energy Research Establishment, Harwell, in December were arranged. A Branch Dinner was also held.

Scottish Branch. — Chairman : Professor W. H. J. Childs succeeded by Dr. J. M. A. Lenihan. *Honorary Secretary :* Mr. T. H. O'Beirne. (280 members.)

Eleven lectures were held in Glasgow, eleven in Edinburgh, two in Aberdeen and one in Dundee. A course of five lectures on computers was also arranged. A meeting was held jointly with the Non-Destructive Testing Group at the Royal Technical College, Glasgow.

South Wales Branch.—Chairman : Mr. R. G. Wood. *Honorary Secretary :* Dr. M. R. Hopkins. (270 members.)

Three lectures were held in Cardiff, two in Swansea and one in Aberystwyth.

North-Eastern Branch.—Chairman : Professor W. E. Curtis. *Honorary Secretary :* Dr. N. Thorley. (119 members.)

Six lectures were held in Newcastle-upon-Tyne and one at Durham.

Yorkshire Branch.—Chairman : Professor E. C. Stoner. *Honorary Secretary :* Dr. R. S. Tebble. (249 members.)

One lecture was held in Sheffield and one in Leeds. A summer visit was arranged to the Wool Industries Research Association in July.

A conference on the training of physicists for industry was held at Rotherham Technical College in April.

Education Group. — Chairman : Dr. J. Topping. *Honorary Secretary :* Mr. F. Y. Poynton. (284 members.)

Four lectures were held in London. The annual conference was held at the Institute's House in April and the summer meeting in Cambridge in June.

Electronics Group.—Chairman : Mr. G. W. Warren succeeded by Mr. M. E. Haine. *Honorary Secretary :* Mr. S. Rodda. (367 members.)

Six lectures were held in London, and one lecture was held jointly with the Midland Branch in Birmingham. A visit to the Atomic Energy Research Establishment was made in June and a symposium on recent developments in magnetic materials was held in London in September.

Industrial Spectroscopy Group — Chairman : Mr. D. M. Smith. *Honorary Secretary :* Mr. J. R. Stansfield. (163 members.)

Four lectures were held in London. A summer meeting was arranged to the Physics Department of the University of Birmingham, Imperial Chemical Industries Ltd., and the Mond Nickel Co. Ltd., in July.

Electron Microscopy Group.—Chairman : Dr. V. E. Cosslett succeeded by Dr. D. G. Drummond. *Honorary Secretary :* Dr. C. E. Challice. (254 members.)

The annual group conference was held at the University of Glasgow in July.

Non-Destructive Testing Group.—Chairman : Mr. W. E. Schall succeeded by Dr. J. Thewlis. *Joint Honorary Secretaries :* Mr. R. Meakin and Mr. B. R. Byrne succeeded by Mr. R. S. Sharpe. (337 members.)

Eight lectures were held in London. A symposium was also held in London. The summer meeting was held jointly with the Scottish Branch at the Royal Technical College, Glasgow.

Stress Analysis Group.—Chairman : Mr. E. D. Frankl. *Honorary Secretary :* Mr. B. Sugarman. (149 members.)

The annual group conference was held at the University of Sheffield.

X-Ray Analysis Group.—Chairman : Mr. H. P. Rooksby. *Honorary Secretary :* Mr. E. J. W. Whittaker succeeded by Dr. U. W. Arndt. (424 members.)

The spring conference of the group was held at the University of Bristol. The autumn conference of the group was held at the Institution of Civil Engineers, London.

Work under the direction of Professor A. J. C. Wilson has continued at the University College, Cardiff, on the provision of data for the index of diffraction patterns which is published by the American Society for Testing Materials. A new project of collecting single crystal data for determinative and reference purposes has been initiated at the University of Leeds under Professor E. G. Cox. The publication of the sixth section of the index was announced in America and the Institute will again act as agent for its distribution. The proceeds from the sales of these copies, which are presented to the Institute by the American Society, are held in trust by the Institute for the Group and provide the source from which the work at Cardiff and at Leeds is financed.

The Group's Equipment Sub-Committee has continued its work.

Extracts from Reports to the Board of Representatives and Nominees on Joint Committees and other Bodies

Parliamentary and Scientific Committee. — During the year the Committee amended its constitution to enable the three major engineering institutions to become associated with it. Once again throughout the year the Committee has continued to interest itself actively in problems connected with higher technological education and scientific manpower. A deputation (on which The Institute of Physics was represented) waited on the Minister of Education on May 4 and again on July 18. Parliamentary members

of the Committee have frequently spoken in both Houses on these two subjects. The Committee has also concerned itself with the higher postal rates for scientific journals and publications, and with the rating and valuation of the premises of research associations, scientific societies, etc.

The Committee held seven meetings, and amongst the subjects on which it was addressed were the following : Radiological hazards from nuclear explosions and nuclear power developments ; Some aspects of the scientific manpower problem ; International geophysical year ; Post-war scientific progress in Germany.

Committee of Management of "Science Abstracts."—During the year the Committee met three times to consider financial provisions, new printing arrangements and the preparation of a five year index. Suggestions for extending the coverage and other improvements were also considered.

Royal Society's Paul Instrument Fund Committee.—The Committee has met several times during 1955. No grants for new projects have been made but a total of £6,300 has been granted in support of four projects begun in 1954.

Joint Council of Professional Scientists.—The Council met in October for an exchange of views between representatives of the various scientific professional institutions, on the National Council for Awards in Technology, on sources of qualified scientists, and on the facilities available for graduates and non-graduates to obtain higher degrees on research work carried out in industry or research associations. The representatives of those bodies which were about to prepare remuneration statistics agreed that so far as possible the data should be presented in comparable form.

Joint Committee (with the American Society for Testing Materials and The American Crystallographic Association) on Chemical Analysis by Powder X-ray Diffraction Methods.—The sixth set of data cards (issued in the U.S.A. late in 1955) contains numerous corrections and supplementary data for substances in earlier sets. An independent collection of corrections mainly from British sources has been prepared and will be circulated early in 1956.

The Institute of Physics representative on this Committee was able to spend ten days in the U.S.A. during November, attending a meeting of the Editorial Board of the Joint Committee, and discussing problems concerning the index with several members of the Committee. These discussions will be of great value in planning the programme of future work in Cardiff, which is paid for from the proceeds of the sale of the copies of the index presented to the Institute by the American Society which publishes it.

London Regional Advisory Committee in Applied Physics.—The Committee has continued to be very active, especially in the completion of its proposed scheme for a full time course in applied physics. This was submitted to the University of London with a suggestion that a degree could appropriately be awarded on it. The University's reply was not encouraging. The Committee has proposed the holding of a conference on the subject of Graduate Studies in Applied Physics, jointly with the Institute.

Regional Council for Further Education for the South West.—The Council has continued its activities, expanding the number of courses available, and is now giving serious consideration to the provision of increased facilities to meet the needs of the oncoming "bulge." Increased attention has been paid to the provision of "sandwich courses."

The Governing Body of Croydon Technical College.—The Governors met three times during the year, and a new Science Advisory Committee with Institute of Physics representation has been formed. Consideration has been given, among other matters, to improvements in the course for the Higher National Certificate in Applied Physics, and to the possibility of providing training in the use of radioactive isotopes.

The Governing Body of Norwood Technical College.—The Governors have been concerned with the growing demand for physics teaching and it has now been agreed to divide the work of the existing department into telecommunications engineering, and mathematics and physics.

Advisory Panel for Physics of the Yorkshire Council for Further Education.—During 1955 one full meeting of this Panel has been held. Reports were received of Advanced and Specialized Courses in physical subjects arranged in the district, and other proposed courses were discussed. In co-operation with the County Advisory Committee for Metallurgy, a meeting of industrialists was held to discuss a proposed Short-Term Course on Metal Finishing, and it was decided to arrange this. Suggestions for modifying the standard of mathematics required in the National Certificate Course in Applied Physics were put forward for consideration by the Joint Committee for National Certificates in Physics.

Advisory Committee in Applied Science of Wolverhampton and Staffordshire Technical College.—This Committee has met twice during the year and has approved the courses to be followed in the Applied Science Department at all levels. Research programmes have been discussed and important research contracts have been received from industrial concerns.

Science Advisory Committee of the Governing Body for Technical and Further Education, Slough Area.—An inspection has been made of the first stage of the new buildings which are now occupied. The question of research by the staff in conjunction with local industry has been discussed.

Advisory Committee for Science of the Luton and South Bedfordshire College of Further Education.—The Committee learnt of the progress being made in the building extensions of the College and is interesting itself in sandwich courses.

Science Advisory Sub-Committee of the Poole College for Further Education.—The Committee has discussed an expanded programme which will start in September, 1956, when new buildings come into use.

Science Advisory Committee of the Bury Municipal Technical College.—The Committee met once and dealt with examination results and the enrolment of science students.

BRITISH STANDARDS INSTITUTION COMMITTEES

Instrument Industry Standards Committee.—The Committee met once during the year to review the work of its several Sub-Committees and to consider proposals for new work.

Units and Symbols Standards Committee.—A draft British Standard, " Glossary of Terms in use for High Vacuum Technology," has been circulated for general comment. B.S.: 350, " Conversion Factors and Tables," has been re-arranged and extended, and a draft of the revision will shortly be circulated for comment. Other standards in preparation include : (1) " Reduction and Presentation of Experimental Results," (2) " Rationalized and Unrationalized Formulae in Electrical Engineering," (3) " Glossary of Terms used in Nuclear Science," (4) " Revision of Definitions of Calorific Value."

Good progress is being made with the preparation of new parts of B.S.: 1991, " Letter Symbols, Signs and Abbreviations," covering the following subjects : (*a*) " Chemical Engineering and Applied Chemistry," (*b*) " Fluid Mechanics," (*c*) " Strength of Materials and Structures," (*d*) " Heat Engines."

Increased attention is being given by the B.S.I. to the use of statistical principles in the preparation of B.S. Specifications, particularly where sampling is involved. Apropos of this subject, B.S.: 2635, " Drafting Specifications Based on Limiting the Number of Defectives Permitted in Small Samples," was published in 1955.

In the ISO field (International Organization for Standardization), the USM Section has taken an active part in the work dealing with units, symbols, conversion factors, etc. ; terminology (principles and co-ordination), and statistical nomenclature.

Joint Sub-Committee with the Institution of Electrical Engineers on Radio Interference from Electromedical and Industrial Radio Frequency Equipment.—The work of the Committee has been confined to the revision of one clause of a Code of Practice by a drafting panel. More extensive revision is anticipated in which discrimination may be made between medical and industrial uses of radio frequency apparatus.

Code Drafting Committee on the Use of Electronic Valves.—The Committee has not held any formal meetings during 1955 but much

work on the new sections of the Code of Practice CP1005, "Use of Electronic Valves," has been done and Part 3 on "Photocells Transmitting Valves and Cold-Cathode Gas-Filled Valves" will be published in the near future.

Technical Committee on Glossary of Rubber Terms.—The work of the Committee has been mainly confined to terms peculiar to the industry, and general theoretical terms will be considered later.

Technical Committee on Radiographic Examination of Welded Joints.—"General Recommendations for the Radiographic Examination of Fusion Welded Joints in Thicknesses of Steel up to 2 in." was issued in March. Work has commenced on a draft for a British Standard with the provisional title "General Recommendations for the Radiographic Examination of fusion-welded, circumferential butt-joints in pipes, in thicknesses of steel up to 4 in."

Sub-Committee on Terminology of Casting Defects.—The draft specification, having been circulated for comment, was amended and passed to the Industrial Committee. Based on their comments the specification has been further amended.

Sub-Committee on Processing Workroom and Finishing Equipment and Accessories.—The Sub-Committee completed the draft standard on processing hangers for sensitized materials.

Sub-Committee on X-ray Film Cassettes.—A preliminary draft standard for X-ray film cassettes has been prepared from data collected.

Sub-Committee on Radioactive Sources and Source Holders.—A draft Standard for "The Dimensions of Radiographic Capsules" was widely circulated for technical comments, which has been carefully considered during the preparation of a revised draft. The task of standardizing source-holders would have been easier before the introduction of a large and valuable stock of sources for radiography. It is now wise to depart slightly from the optimum physical principles in order to include the useful existing designs which must remain in circulation for many years. Radon source-holders do not present this difficulty because of the short half-life and the surprisingly small number in use in British industry. A separate design is therefore advocated.

Sub-Committee on Barytes for Plaster and Concrete.—After a long period of inactivity, the Committee was re-convened and met three times during the year ; a draft standard has been circulated for comment.

Sub-Committee on Glossary of Terms Used in Nuclear Science.—The Committee met eleven times during 1955, each meeting lasting almost the whole day. Most of the work of the Committee during the year was confined to defining terms in nuclear physics, reactor physics and instrumentation. The nuclear physics terms are very nearly completed and a considerable proportion of the terms of the other groups have also been defined.

Technical Committee on Radiographic Terms for Welding.—The 1952 "Glossary of Terms (with Symbols) Relating to the Welding and Cutting of Metals" is being revised and expanded. The terminology agreed by or under discussion by the International Standards Organization and by the International Institute of Welding is being considered. "Terms relating to welding imperfections appropriate for radiographic examination are being revised.

J. D. COCKCROFT,
President

S. WHITEHEAD,
Honorary Treasurer

B. P. DUDDING,
Honorary Secretary

H. R. LANG,
Secretary

THE INSTITUTE OF PHYSICS

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST DECEMBER, 1955

1954			1954			
£		£	£		£	£
	To Office and General Expenses :—		11,734	By Members' Subscriptions		12,383
3,344	Salaries and National Insurance	3,341	656	„ Entrance and other fees		738
142	Staff Superannuation	180	88	„ Dividends and Interest less tax		80
1,080	Rent, Rates, Heating, Cleaning, Maintenance, etc.	1,141		„ Contribution from the Endowment Trust Fund for alteration of premises, depreciation of furniture and fittings and leasehold redemption policy :—		
620	Board, Committees' and Officers' travelling expenses	681			£	
666	Printing and stationery	875		Charged to cost of Publications ...	882	
302	Postage and Telephones	373	1,257	Charged to other work	441	1,323
582	List of Members	—				
196	Miscellaneous expenses	294	—	„ Balance being Excess of Expenditure over Income carried to Reserve Fund		1,177
6,932		6,885				
381	„ Depreciation of furniture and fittings	420				
1,671	„ Copies of Journals supplied to Members ...	2,052				
309	„ Amount written off expenditure on alterations, improvements and adaptation of House ...	359				
985	„ Leasehold Redemption Policy	985				
—	„ Grant to Endowment Trust Fund	5,000				
3,457	„ Balance being Excess of Income over Expenditure carried to Reserve Fund	—				
£13,735		£15,701	£13,735			£15,701

THE INSTITUTE OF PHYSICS

BALANCE SHEET, 31st DECEMBER, 1955

1954			
£		£	£
	LIFE MEMBERSHIP FUND :—		
	As at 31st December, 1954...	4,948	
4,948	*Less :* Transfer to Reserve Fund in respect of deceased members	42	4,906
	RESERVE FUND :—		
	As at 31st December, 1954	17,583	
	Add : Transfer from Life Membership Fund	42	
	Sinking Fund Leasehold Property...	985	
		18,610	
17,583	*Less :* Income and Expenditure Account Balance	1,177	17,433
	FURNISHING FUND :—		
	Donations received to 31st December, 1954	2,055	
	Less : Expenditure to date	2,055	—
	CURRENT LIABILITIES :—		
	Payments received from members in advance	733	
1,481	For Expenses	2,726	3,459
1,625	Mrs. Phillips' Bequest		1,770
	J. D. COCKCROFT, *President*		
	S. WHITEHEAD, *Honorary Treasurer*		
£25,637			£27,568

1954		Cost to 31/12/54	Additions during year	Depreciation to 31/12/54	Depreciation during year	
£		£	£	£	£	£
	FIXED ASSETS :—					
1,992	FURNITURE, FITTINGS & OFFICE EQUIPMENT ...	5,082	511	3,089	420	2,084
6,875	ALTERATIONS, IMPROVEMENTS AND ADAPTATION OF PREMISES ...	10,289	—	3,415	359	6,515
8,867						8,599
	CURRENT ASSETS :—					
363	STOCK ON HAND—Stationery				422	
1,205	DEBTORS—Sundry Accounts				1,339	
4,519	DUE FROM THE ENDOWMENT TRUST FUND ...				4,716	
53	SUBSCRIPTIONS IN ARREARS				78	
	INVESTMENTS :					
4,485	Quoted				4,485	
1,000	Unquoted				1,000	
	(*Estimated market value on 31st December, 1955, £4,868*)					
4,925	LEASEHOLD REDEMPTION POLICY ...				5,910	
220	BANK BALANCES AND CASH IN HAND ...				1,019	18,969
£25,637						£27,568

Report of the Auditors to The Members of The Institute of Physics

We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purposes of our audit. In our opinion proper books of account have been kept by the Institute so far as appears from our examination of those books, and proper returns adequate for the purposes of our audit have been received from Branches of the Institute not visited by us. We have examined the above Balance Sheet and annexed Income and Expenditure Account which are in agreement with the books of the Institute. In our opinion and to the best of our information and according to the explanations given to us the said accounts give the information required by the Companies Act, 1948, in the manner so required and the Balance Sheet gives a true and fair view of the state of the Institute's affairs as at 31st December, 1955, and the Income and Expenditure Account gives a true and fair view of the Excess of Expenditure over Income for the year ended on that date.

Spencer House, South Place, London, E.C.2.
7th March, 1956

KNOX, CROPPER & CO., *Chartered Accountants.*

THE INSTITUTE OF PHYSICS—ENDOWMENT TRUST FUND

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST DECEMBER, 1955

1954		£	1954		£
	To Graduates and National Certificates Examinations		£	By Fees for Examinations	
612		700	566		665
2,100	„ Expenses of Branches and Groups	2,093	150	„ Donations	210
350	„ Conference expenses	134	189	„ Interest	339
179	„ Educational booklets and reports	195	33,395	„ Receipts from publications, including advertisements	40,518
	„ Cost of production and distribution of Publications sold		3,734	„ Transfer to Endowment Trust Fund	—
30,755		35,682	1,788	„ Balance carried forward	—
	„ Proportion of overhead charges in connection with the work carried on by the Trust		—	„ Grant from The Institute of Physics	5,000
5,407		5,851			
	„ Contribution to cost of repairs and alterations of House, depreciation of furniture, and Leasehold Redemption Fund				
419		441			
—	„ Balance carried down	1,636			
£39,822		£46,732	£39,822		£46,732
	To Balance being deficit brought forward	1,786		By Balance brought down	1,630
				„ Balance being deficit carried forward	156
		£1,786			£1,786

BALANCE SHEET, 31ST DECEMBER, 1955

1954		£	£	1954		£	£
	ENDOWMENT TRUST FUND :—				INVESTMENTS :—		
100	As at 31st December, 1954		100	5,309	Quoted	5,309	
2,038	Reserve for Book Stock Depreciation		2,000	1,500	Unquoted	1,500	
					(*Estimated market value at 31st December, 1955, £6,167*)	—	6,809
	CURRENT LIABILITIES :—			1,202	SAVINGS BANK DEPOSITS		2,254
10,037	X-Ray Index Fund	12,184		7,298	STOCK ON HAND, PUBLICATIONS AND DISPATCH MATERIAL		5,753
8,871	Publications, Subscriptions in advance	5,510		5,294	SUNDRY DEBTORS, PUBLICATIONS, ETC.		3,544
1,822	Printing and Publishing Expenses	3,765		5,002	BANK BALANCES AND CASH IN HAND		9,765
6	Bowen Prize Fund	—		1,788	INCOME AND EXPENDITURE ACCOUNT BALANCE (deficit)		150
4,519	Due to The Institute of Physics	4,716	26,175				
£27,393			£28,275	£27,393			£28,275

J. D. COCKCROFT, *President*
S. WHITEHEAD, *Honorary Treasurer*

We have audited the above Balance Sheet and have obtained all the information and explanations we have required. We have verified the Bank Balances and the Investments. In our opinion such Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Fund according to the best of our information and the explanations given to us and as shown by the books of the Fund.

Spencer House, South Place, London, E.C.2.
7th March, 1956

KNOX, CROPPER & Co., *Chartered Accountants.*

THE INSTITUTE OF PHYSICS BENEVOLENT FUND

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST DECEMBER, 1955

1954			1954		
£		£	£		£
417	To Grants	436	524	By Subscriptions and Donations	909
303	„ Balance being excess of Income over Expenditure carried to Capital Account	751	120	„ Interest	135
			76	„ Royalties on Books	143
£720		£1,187	£720		£1,187

BALANCE SHEET, 31ST DECEMBER, 1955

1954				1954		
£		£	£	£		£
	CAPITAL ACCOUNT :—			2,633	GOVERNMENT SECURITIES, at cost ... ... (*Estimated market value at 31st December, 1955, £2,249*)	2,633
	On 31st December, 1954	4,473		44	DEBTORS	27
4,473	*Add :* Transfer from Income and Expenditure Account	751	5,224	1,634	CASH ON DEPOSIT AT POST OFFICE SAVINGS BANK ...	2,186
				162	CASH AT BANK	378
	S. WHITEHEAD, *Chairman of Fund Committee* H. R. LANG, *Secretary of Fund Committee.*					
£4,473			£5,224	£4,473		£5,224

We have audited the above Balance Sheet and have obtained all the information and explanations we have required. We have verified the Bank Balances and the Investments. In our opinion such Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Fund according to the best of our information and the explanations given to us and as shown by the books of the Fund.

Spencer House, South Place, London, E.C.2.
7th March, 1956

KNOX, CROPPER & CO., *Chartered Accountants.*

Forthcoming Institute Meetings

Apl. 20 South Wales Branch At the University College of Wales, Aberystwyth, 8.00 p.m.

"*The Concept of Temperature near Absolute Zero*"

SIR FRANCIS SIMON, C.B.E., F.Inst.P., F.R.S.
(University of Oxford)

Apl. 26 Midland Branch At Birmingham Exchange and Engineering Centre, 7.00 p.m.

"*The Physics of Wood*"

MR. R. F. S. HEARMAN, F.Inst.P.
(Forest Products Research Laboratory)

May 2 North Eastern Branch At King's College, Newcastle-upon-Tyne, 6.15 p.m.

"*Technical Application of Transistors*"

MR. E. WOLFENDALE
(Mullards Research Laboratories)

Tea will be served at 5.30 p.m.

May 4 Non-Destructive Testing Group At the Institute's House, 6.30 p.m.

A discussion meeting on

"*Physical Principles of Penetrant Methods*"

(Admission by ticket obtainable from the Deputy Secretary)

May 11 Liverpool and North Eastern Branch 6.30 p.m.

In the Department of Electrical Engineering, University of Liverpool.

Branch Annual Meeting

followed by

"*Mass Spectrometry*"

DR. P. B. F. EVANS, A.Inst.P.
(Atomic Energy Authority, Capenhurst)

The Institute's Journals

PRINCIPAL CONTENTS OF THE APRIL, 1956, ISSUES

Journal of Scientific Instruments: Volume 33, No. 4

PAPERS

A magnetic spectrometer. By D. J. Prowse (*H. H. Wills Physical Laboratory, University of Bristol*), and W. M. Gibson (*Physics Department, Queen's University of Belfast*).

A little-known type of magnetic spectrometer, for measuring the energy of heavy charged particles, is described. The principle is due to P. H. Fowler ; the source is outside the region of magnetic field, which particles enter and leave across a straight boundary ; particles of different energies are brought to second-order foci at points along a line which also lies outside the region of magnetic field. The principles and the factors limiting the resolution are discussed briefly. The design and performance of an instrument built for protons of energy up to 8 MeV are described ; a resolution of up to 1 in 800 in momentum has been obtained.

A water vapour recorder for equatorial use. By C. G. Webb, A.Inst.P., and A. Rajaratnam (*University of Malaya, Singapore*).

A considerable extension of the range and accuracy of the thermocouple hygrometer is possible in an equatorial climate, owing to the small range of variation of atmospheric pressure and temperature. An instrument, with a linear range of water vapour pressure of 10-30 mm of mercury, has been designed for use in latitudes 0 ± 5°. Systematic departures from linearity were less than 0·2 mm on direct calibration. The use of a new reference temperature close to the mean air temperature is convenient, and with it a single check measurement suffices for standardization of the hygrometer.

An automatic scanner for nuclear emulsions By S. J. Goldsack and H. B. van der Raay (*University of Birmingham*).

A photoelectric method of obtaining the angular distribution of tracks in nuclear emulsions is outlined. Details of the apparatus constructed and its performance are given. The angular resolution is about ½° and the apparatus can be made to accept tracks of minimum grain density.

A versatile X-ray diffractometer for single-crystal and powder studies. By A. R. Lang, A.Inst.P. (*Cavendish Laboratory, University of Cambridge*).

A robustly constructed instrument is described which can be adapted to a wide variety of diffraction techniques. Specimen axis and counter arm are independantly rotatable, manually or automatically, and are both carried by opposed tapered roller bearings. Following a predetermined programme, spectrum scanning may be performed at two speeds : slowly at angles of interest, and fast elsewhere. Graphical recorder indication of diffracted intensity can be made independent of X-ray output fluctuations by using a potentiometer reference voltage proportional to X-ray tube current.

Application of the electrostatic precipitator to the measurement of radioactive aerosols. By B. A. Bergstedt (*AB Atomenergi, Department of Physics, Stockholm, Sweden*).

A continuous air monitor and a portable dust sampler are described both using a new type of electrostatic precipitator. In the continuous air monitor the dust is collected on a moving aluminium tape which then passes the radiation detectors. The precipitator is operated at very low efficiency giving a high sensitivity which is nearly independent of air flow rate. The effective drift velocity of the particles towards the collection surface is more than ten times that in the Cottrell-type precipitator.

An improved helium liquefier and cryostat. By D. F. Brewer and D. O. Edwards (*Clarendon Laboratory, University of Oxford*).

A Linde helium liquefier-cryostat suitable for visual observations is described. It is similar to the Daunt and Mendelssohn type, but has greatly improved characteristics. Modifications have been made in the method of pre-cooling the circulating gas to 90° K and in the heat interchangers. A separate 14° K stage has also been incorporated. About 750 cm³ of liquid are produced at the rate of one litre per hour.

A magnetic analyser for high energy particles. By A. Lovati and H. Tyrén (*The Gustaf Werner Institute for Nuclear Chemistry, University of Uppsala, Sweden*).

A magnetic analyser for accurate measurement of momentum of nuclear reaction products, employing two-directional focusing with a sector-shaped uniform magnetic field, is described. The instrument is useful for analysing particles with magnetic rigidity up to 2 x 10^6 G. cm (corresponding to 180 MeV protons and α-particles, 90 MeV deuterons, etc.).

An instrument for measuring respiratory rates and volumes. By W. Nisbet (*The Hannah Dairy Research Institute, Kirkhill, Ayr*).

Fluctuating flow-rates, total flow volumes and the frequency of an alternating flow are measured by an instrument which has been used in respiration studies on the calf. The instrument consists of three units, one, a flow-sensing unit in the form of a fine mesh gauze used under laminar flow conditions ; two, a magnetic induction manometer associated with an amplifier-detector and an oscillator, and three, an electronic integrator.

The flow-rate/pressure relationship of the gauze is practically linear ; ±3·5 l./s producing a pressure drop of ±1·25 mm of water. The amplifier-detector output is ±9 V, d.c. for a pressure of ±1·5 mm of water ; the linearity of the complete manometer is within 1%. The integrator accuracy is normally ±2½% of full scale on any of eight ranges between 0-5 l. and 0-400 l.

Steady flow-rates and total flow are indicated on a 5 in. scale panel meter and instantaneous flow-rates on an external oscilloscope. Integration time is controlled by an electric clock movement and each flow alternation is recorded on an electromagnetic counter.

A logarithmic megohmmeter. By P. Hariharan, A.Inst.P., and M. S. Bhalla (*National Physical Laboratory of India, New Delhi, India*).

An instrument is described which reads resistance values from 1 to 10^5 MΩ on a single, approximately logarithmic scale. It is reliable, easy to operate, and immune to damage by accidental overloads.

LABORATORY AND WORKSHOP NOTES

Simple high-pressure closures and electrodes. *By* D. Gugan.

A simple gas valve. *By* J. Fuller.

A sensitive null-point manometer. *By* J. P. Berry.

Miniature diffraction cameras for micro-focus X-ray units. *By* J. B. Finean

CORRESPONDENCE

Rotating electrode unit for measurements of the electric strength of insulating liquids. *From* A. Powell *and* K. H. Stark.

Modifications of photomultiplier characteristics by dynode voltage control. *From* D. S. Hobbs *and* E. M. Deeley.

A simple apparatus for recording the variation of Hall coefficient with temperature. *From* E. H. Putley.

***British Journal of Applied Physics*: Volume 7, No. 4**

SPECIAL ARTICLE

Physics of the Sun. By Prof. Zdeněk Kopal (*Department of Astronomy, University of Manchester*).

The first part of this paper reviews the fundamental observed data bearing on the physics of the Sun—in particular, its size, mass, and luminosity. In the second part, an outline of the equilibrium model of solar interior is given. It is pointed out that the forces determining its structure are primarily gravitational, and that most of its interior is likely to be in radiative equilibrium. High internal temperature (attaining some 14 x 10^6 °K at the centre) brings about far-reaching ionization which, in turn, permits solar matter to behave like a perfect gas even at a central density of 90 g/cm³, and causes most of the radiant energy leaking slowly outwards to have the nature of soft X-rays. The third part reviews the principal nuclear reactions capable of transforming hydrogen into helium under conditions which prevail in the solar interior, and whose exothermic nature provides the source of energy which causes the Sun to shine. It is pointed out that a high temperature-dependence of such reactions restricts the actual energy production essentially to central portions of the Sun ; and high opacity of its internal matter is bound to keep this central thermonuclear reactor of the solar system burning at an exceedingly steady rate. The concluding section of this paper reviews the physics and chemistry of the solar visible surface and its atmosphere. It is

pointed out that most phenomena observed in these regions involve but minute transport of mass ; but unlike in the interior, the forces governing them are electromagnetic rather than gravitational. The survey ends with a brief description of the solar corona, whose physical structure is dominated by a temperature of the order of 10^6 °K. Dynamically the corona is a fleeting, unstable phenomenon constantly dissolving and being replenished ; but the source of the energy necessary for the maintenance of so high a temperature remains one of the great unsolved puzzles of solar physics.

Papers

An apparatus for the accurate control of the peak X-ray energy of a 20 MeV betatron. By K. Phillips, (*Research Department, Metropolitan-Vickers Electrical Co. Ltd., Manchester 17*).

Two methods on the accurate control of the electron energy of a 20 MeV betatron are described in detail. In one method a current transformer supplies a reference voltage in phase with the current in the betatron magnet coils to a trigger and potentiometer control unit. The second method uses a peaking transformer which is connected in series with the betraton magnet coils and supplies a pulse to a differentiating amplifier. The time of firing of the peaking transformer during the acceleration cycle is controlled by means of a high-current, low-voltage stabilizer. The same trigger circuit and expander modulator are used in both methods. A detailed comparison of the performance of the two methods is made and their advantages and limitations are discussed.

Fields and stresses in dielectric media. By G. Power (*University of Nottingham*).

The Maxwell stresses are here considered and are used to obtain, in two dimensions, expressions for the mechanical forces experienced at the boundary of an isotropic dielectric owing to the presence of an electric field. Special dielectric boundary shapes are discussed, and the method of conformal transformation is employed in order to satisfy more easily the boundary conditions that are imposed on the fields. A number of cases are studied in detail, and experimental verification is obtained by use of the electrolytic tank.

A new method for the measurement of rapid fluctuations of temperature. By R. Dehn, A.Inst.P. (*The General Electric Co. Ltd., Wembley, Middlesex*).

The method described uses a photomultiplier in conjunction with an infra-red image converter to measure changes in surface temperature of the cathode of an oscillating magnetron during microsecond pulses.

These instantaneous changes in temperature are displayed as pulses on the screen of a cathode-ray oscillograph. The procedure is given of calibrating the apparatus against an optical pyrometer. Changes as small as 2° C in 800-900° C have been detected (solid angle equals $2{\cdot}5 \times 10^{-5}$ steradians).

The measurement of the electrical resistivity of silicon. By R. H. Creamer, A.Inst.P. (*The General Electric Co. Ltd., Wembley, Middlesex*).

A modified four-probe method is described which employs probes made from wires containing a donor or acceptor type impurity for *n*- or *p*-type silicon respectively. By discharging a condenser between the probes, low resistance stable contacts are obtained which allow a steady current to flow in the specimen and permit the potential to be measured with a standard potentiometer. Resistivity measurements by the normal method and by the four-probe method are compared ; the latter measurements give an accuracy of about $\pm 7\%$ for resistivities up to several hundred ohm centimetres.

The Eberhard effect in X-ray powder photographs. By T. W. Baker (*Atomic Energy Research Establishment, Harwell, Berks*).

The Eberhard effect is briefly described and observed spurious doublets in X-ray powder photograph positives are attributed to this cause. It is also considered that high angle doublets used for accurate lattice parameter measurement will suffer displacement due to this effect, and an example of this is quoted. The effect will also introduce intensity discrepancies in lines that are close together.

Correspondence

Ultra-violet polymerization of embedding monomers for thin sectioning.
From A. Charles *and* J. Sikorski.

Vapour lubrication of titanium and zirconium.
From G. W. Rowe

Observations on the characteristics of the cold cathode ionization gauge.
From J. H. Leck *and* A. Riddoch.